NASA STTR 2019 Phase I Solicitation

T2.03 Performance Demonstration of High Payoff Propulsion Technology: Rotating Detonation Engine and Dual Mode Ionic Liquid

Lead Center: MSFC

Participating Center(s): GRC, MSFC

Technology Area: TA2 In-Space Propulsion Technologies

NASA is soliciting proposals for performance demonstrations of lower Technology Readiness Level (TRL) high payoff propulsion technology. The objective is to gain performance data to validate previous or concurrent analytical performance predictions of the technology. Conventional propulsion systems are highly mature with diminishing returns for investments in evolutionary steps of higher performance. Proposals only addressing the following focus areas will be considered:

Rotating Detonation Engines - Rocket Applications

New technologies such as the rotating detonation engine (RDE) offers a step function improvement over state-of-the-art alternatives. However, RDE diagnostics and analytical models are limited for system performance characterization and design optimization. This topic has an objective of anchoring either existing or concurrent RDE model validation efforts. The proposals may include novel diagnostic solutions for system characterization in the challenging environment. This topic seeks to advance the capabilities for RDE thermal design, injector design, and pressure loss optimization. Phase II must include hot-fire testing for analytical model validation activities and/or advanced RDE diagnostics performance demonstration.

Dual Mode Propulsion

The government has spent significant resources to mature and demonstrate the non-toxic propellants (e.g., AF-M315E). In addition to anticipated life cycle cost reductions, these non-toxic propulsion systems have comparable or better performance as state-of-the-art alternatives. Today, many spacecraft carry two propulsion options: high thrust propulsion for high acceleration maneuvers (such as orbit insertion) and high specific impulse (low thrust) for station keeping and less time critical maneuvers. Dual mode operation is conventionally flown in two ways: as either a single propellant system, which typically offers lower performance in lieu of cost and packaging advantages or has independent propellant systems (e.g., hydrazine and xenon) to maximize performance. However, AF-M315E has been shown to have acceptable performance for combustion high thrust systems as well as low thrust variants. Near-term investments are anticipated to field both high thrust and low thrust systems. This solicitation seeks innovative solutions for interfacing with a common propellant tank for dual mode operation and validate integrated system performance. The Phase I proposal must include innovative propellant conditioning solutions with breadboard or higher fidelity hardware and the Phase II deliverables must include flight weight and efficient packaging systems that matches the proposed system architecture.

The expected TRL for this project is 3 to 5.